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Cataract Surgery in Eyes with Filtered Primary Angle Closure Glaucoma

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Purpose: To evaluate the effect of cataract surgery on intraocular pressure (IOP) in filtered eyes with primary angle closure glaucoma (PACG).
Methods: In this prospective interventional case series, 37 previously filtered eyes from 37 PACG patients with mean age of 62.1±10.4 years were consecutively enrolled. All patients had visually significant cataracts and phacoemulsification was performed at least 12 months after trabeculectomy. Visual acuity, IOP and the number of glaucoma medications were recorded preoperatively, and 1, 3, 6 and 12 months after surgery. Anterior chamber (AC) depth was measured preoperatively and 3 months after cataract surgery with A-scan ultrasonography. The main outcome measure was IOP at 12 months.
Results: IOP was decreased significantly from 18.16±5.91 mmHg at baseline to 15.37±2.90 mmHg at final follow-up ($P<0.01$). The mean number of glaucoma medications was significantly decreased from 1.81±0.24 to 0.86±1.00 ($P=0.001$) at 1 year postoperatively. At final follow up, 36 (97.2%) eyes and 32 (86.4%) eyes had IOP $\leq$21 and IOP $\leq$18 mmHg, respectively; 14 (37.8%) eyes and 9 (24.3%) eyes had IOP $\leq$21 and IOP $\leq$18 mmHg without medications, respectively. The magnitude of IOP reduction was correlated with higher preoperative IOP ($r=0.85$, $P<0.001$), shallower preoperative AC depth ($r=-0.38$, $P=0.01$) and greater changes in AC depth ($r=-0.39$, $P=0.01$).
Conclusion: Cataract surgery reduces IOP and the number of glaucoma medications in previously filtered PACG eyes. This reduction seems to be greater in patients with higher preoperative IOP and shallower anterior chambers.

Keywords: Cataract Surgery; Trabeculectomy; Angle Closure; Glaucoma

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INTRODUCTION

Trabeculectomy increases the risk of cataract formation and progression. The most important risk factors for developing cataracts in eyes that have undergone trabeculectomy are age, postoperative hypotony and a flat anterior chamber (AC). The higher risk of shallow AC after trabeculectomy in patients with primary angle closure glaucoma (PACG) may result in accelerated progression of cataracts.[1-3]

Cataract surgery can adversely affect the function of the filtering bleb and reduce the success rate of subsequent trabeculectomy.[4-9] Although the exact mechanism remains unclear, it has been suggested that cataract surgery may diminish IOP control by stimulating fibrosis at the trabeculectomy site due to postoperative inflammation, or intraoperative conjunctival manipulation.[10] This evidence is based on studies that included patients with open angle glaucoma or a heterogeneous group of patients.[4-9] On the other hand, phacoemulsification and intraocular lens (IOL) implantation might decrease IOP in eyes with acute and chronic angle closure glaucoma by opening the anterior chamber angle.[11,12] Therefore on theoretical grounds, cataract extraction in filtered PACG eyes might increase IOP by compromising the bleb or reduce IOP by increasing AC depth and angle width.

Phacoemulsification in filtered PACG eyes poses certain challenges including small pupils, shallow AC, large lenticular mass, weak zonules and poor endothelial reserve. These conditions may result in complications such as corneal edema and posterior capsule rupture.[8,13]

Limited studies have evaluated the effect of phacoemulsification on IOP in eyes with PACG and previous trabeculectomy.[8] In this prospective study, we investigated the effect of phacoemulsification on trabeculectomized PACG eyes in terms of IOP control.

METHODS

Study Subjects

This prospective case series was performed from December 2007 to April 2010 at the Glaucoma Clinic, Farabi Eye Hospital, Tehran, Iran. The study was approved by the Ethics Committee at Tehran University of Medical Sciences. All patients provided informed consent in accordance with the Declaration of Helsinki. The study sample comprised of 37 consecutive PACG patients with history of trabeculectomy. Inclusion criteria were a diagnosis of PACG based on gonioscopy, i.e. trabecular meshwork not visible in at least three quarters and/or the presence of peripheral anterior synechiae (PAS), glaucomatous optic disc excavation or visual field defects, visually significant cataracts and history of trabeculectomy at least 12 months prior to enrollment. Exclusion criteria consisted of a history of an acute attack of primary angle closure and neovascular, inflammatory, or other secondary types of angle closure glaucoma.

Preoperative Assessment

Preoperatively, all participants underwent a comprehensive ophthalmologic evaluation including slit lamp biomicroscopy, dilated fundus examination with a 78 diopter lens, best corrected visual acuity (BCVA) measurement in logarithm of minimum angle of resolution (LogMAR) notations, IOP (mmHg) measured with a calibrated Goldmann applanation tonometer, gonioscopy, and 24-2 Humphrey visual fields (Carl Zeiss Meditec AG, Jena, Germany). The anterior chamber angle was graded as: 4, a wide open angle with visible ciliary body band; 3, an angle with visible scleral spur; 2, an angle with visible posterior trabecular meshwork; 1, an angle in which only the Schwalbe line is visible; and; 0, an angle with no visible angle structure. Angle grading and current glaucoma medications were recorded. Anterior segment biometry was performed with an A-scan ultrasound device (Echoscan, U3300, Nidek Co. Ltd., Gamagori, Japan).

Surgical Procedure and Postoperative Assessment

All operations were performed under topical anesthesia on an outpatient basis by a single surgeon (SM). Phacoemulsification was performed through a 3.2-mm temporal clear cornea incision and an AcrySof intraocular lens (SA60AT, Alcon Laboratories, Fort Worth, TX, USA) was implanted within the capsular bag after aspirating cortical material. Postoperatively, a topical corticosteroid and antibiotic were administered for one week. The topical steroid was tapered weekly over an additional 3 weeks.

Postoperative assessment included slit lamp examination, determination of BCVA, IOP measurement, gonioscopy, and number of anti-glaucoma medications. Postoperative values were measured at the 1, 3, 6, and 12 month visits. AC depth was measured at month 3 in all cases using A-scan ultrasound. Glaucoma medications were continued based on IOP and clinical status of the operated eye.

Postoperative IOP was the primary outcome measure. Complete success was defined as IOP $\leq$ 21 mmHg (definition 1) and IOP $\leq$ 18 mmHg (definition 2) without any glaucoma medications. Qualified success was applied to the same IOP levels mentioned above, using 2 medications or less. Failure was defined as IOP>21 mmHg and IOP>18 mmHg with medications or in case an eye with lower IOP required more than 2 medications.[7]

Statistical Analysis

SPSS software version 13.0 (IBM Corp., New York, NY, USA) was used for statistical analysis. P values of 0.05 or less were considered to be statistically significant. Pre- and postoperative values were compared using the paired t-test. Univariate regression analysis was performed to assess the correlation between IOP and other variables.

RESULTS

Thirty-seven eyes of 37 patients including 13 male and 24 female subjects with mean age of 62.1±10.4 (range: 45-81) years were included. Mean interval between trabeculectomy and cataract surgery was 16.8±6.8 (range: 12-48) months. BCVA (LogMAR) was improved significantly from 1.22±0.81 preoperatively to 0.62±0.44 at month 1 (P<0.001); 0.60±0.39 at month 3 (P<0.001) and; 0.62±0.44 at month 12 (P<0.001). Average angle width increased significantly from grade 0.31±0.51 preoperatively to grade 2.01±0.73 at one year postoperatively (P<0.001). Table 1 and Figure 1 present mean pre- and postoperative IOPs at each visit. There was a statistically significant decrease in IOP from 18.16±5.91 (range: 10-40) mmHg at baseline to 15.37±2.90 (range: 10-22) mmHg 12 months after surgery (P<0.01). The number of medications was reduced from 1.81±0.24 preoperatively to 0.86±1.00 at one year (P=0.001, Fig. 1).

Preoperatively, 7 eyes had IOP>21 mmHg with medications. At one year, 36 (97.2%) eyes had IOP ≤ 21 mmHg including 14 (37.8%) eyes off medications. At one year, 32 (86.4%) eyes had IOP ≤ 18 mmHg including 9 (24.3%) eyes off medications. Tables 1 and 2 present success rates in terms of IOP before and after cataract

Table 1. Success criteria before and after surgery based on intraocular pressure of 21 mmHg or less

		Success at final follow-up			
		Complete (No.)	Qualified (No.)	Failure (No.)	Sum (No.)
Success before cataract surgery	Complete (No.)	5	3	0	8 (21.6%)
	Qualified (No.)	6	11	0	17 (45.9%)
	Failure (No.)	3	6	3	12 (32.4%)
	Sum (No.)	14 (37.8%)	20 (54.1%)	3 (8.1%)	

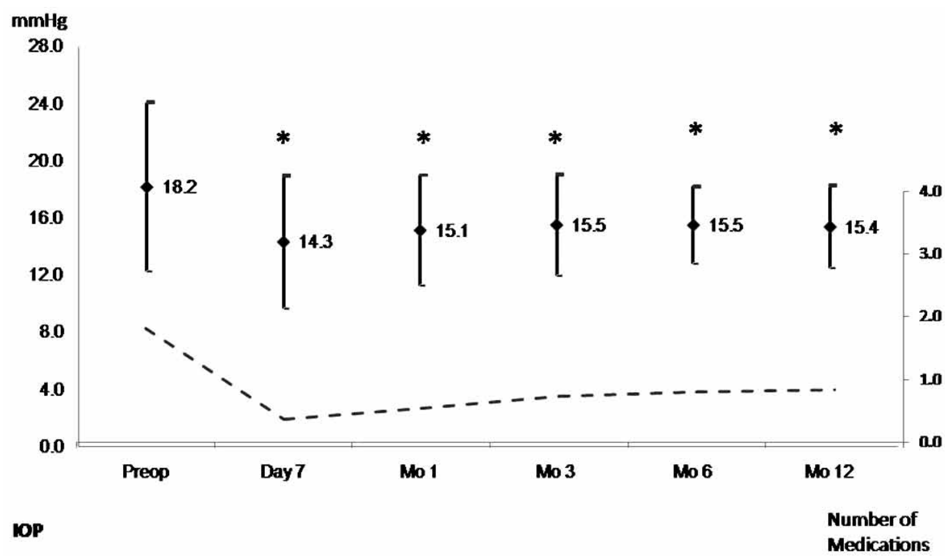

Figure 1. Intraocular pressure and number of medications before surgery, on day 7, and at months 1, 3, 6, 9 and 12 after surgery (*P<0.05).

surgery. All cases with preoperatively controlled IOP (either complete or qualified according to definition 1), had controlled IOP (either complete or qualified) after surgery. Five out of 8 (62.5%) patients with complete success (definition 1) before surgery were also categorized as complete success at final follow-up. Six out of 17 (34.7%) patients in the qualified success group preoperatively, did not require any medication postoperatively. The rate of failure (definition 1) decreased from 32.4% preoperatively to 9.1% at one year postoperatively (Table 1). In the 7 patients with preoperative IOP> 21 mmHg, mean IOP decreased by 11.28±7.11 mmHg from 27.86±6.17 mmHg preoperatively to 16.57±2.22 mmHg, postoperatively. In patients with preoperative IOP ≤ 21 mmHg, mean IOP decreased non-significantly from 15.90±2.75 mmHg to 15.10±3.01 mmHg (P=0.22) at one year. AC depth increased significantly from 2.21±0.32 mm preoperatively to 2.57±0.30 mm postoperatively (P<0.001).

There was a statistically significant correlation between IOP reduction and preoperative AC depth (r=-0.38, P=0.01); and also between IOP reduction and AC depth change (r=0.39, P=0.01). There was no correlation between IOP changes and sex, age, or interval between trabeculectomy and cataract surgery (P>0.05 for all comparisons). Figure 2 is a scatter plot of preoperative IOP against changes in IOP, as well as preoperative IOP and changes in AC depth. The magnitude of IOP reduction was significantly correlated with preoperative IOP (r=0.85, P<0.001). Mean preoperative IOP in patients with high IOP at final follow up was 14.00±2.25 mmHg, which was significantly lower than the preoperative IOP in remaining patients (20.16±6.11 mmHg) (P<0.001).

There were no cases of posterior capsule rupture in this series. Two patients developed corneal edema which resolved spontaneously within the first 2 weeks postoperatively. Two cases developed a fibrin reaction that required an increase in the topical corticosteroid regimen and the use of cycloplegics. No patients required additional glaucoma surgery.

DISCUSSION

Cataract surgery in PACG provides the opportunity to address two pathologies with one intervention: restoring vision and eliminating a narrow angle.[14] Cataract surgery is increasingly

Table 2. Success criteria before and after surgery based on intraocular pressure of 18 mmHg or less. No. denotes number

		Success at final follow-up			
		Complete (No.)	**Qualified (No.)**	**Failure (No.)**	**Sum (No.)**
Success before cataract surgery	Complete (No.)	3	2	2	7 (18.9%)
	Qualified (No.)	2	8	2	12 (32.4%)
	Failure (No.)	4	10	4	18 (48.6%)
	Sum (No.)	9 (24.3%)	20 (54.1%)	8 (21.6%)	

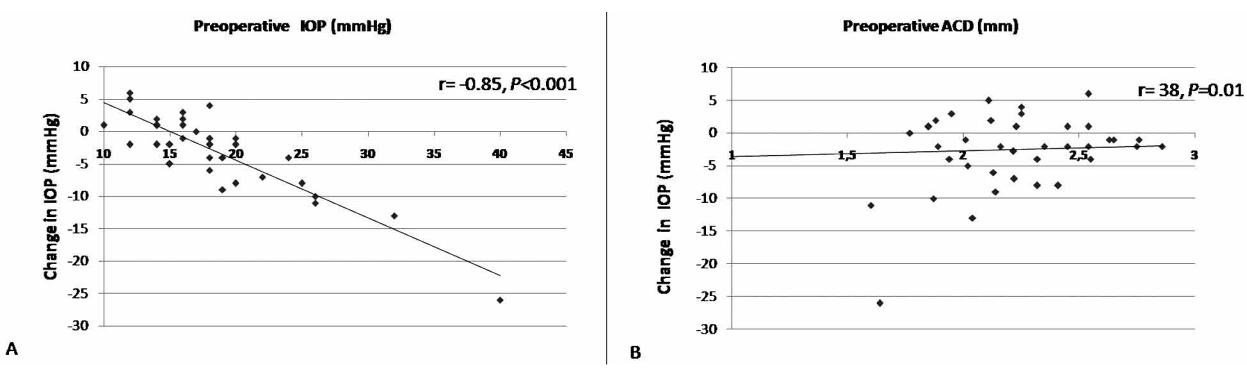

Figure 2. Correlation between change in intraocular pressure (IOP, mmHg) and preoperative IOP (A), and preoperative anterior chamber depth (B).

replacing phacotrabeculectomy for PACG eyes and is associated with IOP reduction.

In this study, a significant decrease in IOP and the number of medications was observed following phacoemulsification in PACG eyes with previous filtering surgery. There are conflicting reports on postoperative IOP changes after cataract surgery in trabeculectomized eyes with primary open angle glaucoma, ranging from a decrease of 0.8 mmHg to an increase of 6.6 mmHg.[4,9] According to the literature, 10 to 61% of trabeculectomies fail 12 to 36 months post-cataract surgery.[16] A case-control study with two years of follow-up reported that 24% of trabeculectomies undergoing cataract extraction failed, as compared to a 7% failure rate in eyes which did not undergo cataract surgery during the same period.[17]

The mean amount of IOP reduction following cataract surgery was 2.8 mmHg at final visit. This level of IOP reduction is greater than previous reports on POAG patients.[4-7] Although a considerable portion of our patients were categorized as qualified success before cataract surgery, all cases with preoperatively controlled glaucoma (either complete or qualified) had successful IOP control postoperatively. This figure exceeds the 56%, 73%, and 83% rates of IOP control in patients with POAG as reported by Ehrnrooth et al,[7] Sharma et al,[18] and Shahid et al,[19] respectively.

There is relative paucity of studies on the efficacy and safety of cataract surgery in filtered PACG eyes.[8,20,21] In most of these studies, the results of PACG and POAG patients were not analyzed separately. Sudarshan et al[8] published the largest study and evaluated bleb function in 60 angle closure glaucoma eyes with prior successful trabeculectomy (IOP<21 mmHg). These authors did not find a significant difference between mean preoperative and postoperative IOP after 6 months and stated that phacoemulsification in these eyes does not affect bleb function. Our results concur with Sudarshan et al[8] for eyes with IOP less than 21 mmHg.

Although modest IOP reduction has been reported after phacoemulsification in patients with POAG,[22-24] cataract surgery is widely accepted to be beneficial in patients with PACG. A decrease of 6 to 12 mmHg in IOP has been previously reported in this group of patients.[11,12] Hayashi et al[25] reported that 40.0% of PACG patients did not require glaucoma medications after cataract surgery. It is generally accepted that relief of pupillary block, opening of the anterior chamber angle, and reducing the extent of PAS are possible mechanisms for IOP decrease in these patients.[11] In our study, although the angle opened and AC depth increased, we could not determine which factor was more important in decreasing IOP. Angle width has not been reported to be significantly changed after trabeculectomy.[26] On the other hand, relief from chronic appositional closure due to intumescent lenses with shallow anterior chambers may be responsible for the significant decrease in IOP observed following cataract surgery especially in cases with higher preoperative IOP. In eyes with PACG, an increase in PAS formation may occur after peripheral iridotomy or trabeculectomy[26] which may further explain the IOP lowering effect of cataract surgery. A detailed evaluation of changes in gonioscopic appearance and AC depth after trabeculectomy might be helpful in clarifying the mechanisms of IOP reduction as observed in our study.

Previous studies have reported an inverse correlation between preoperative IOP and success in IOP control after cataract surgery in trabeculectomized POAG eyes. Most of these studies found that final IOP is greater when the preoperative value is higher.[10,18] In contrast, in the current series mean preoperative IOP in eyes with high IOP at final visit was 14.00 mmHg, which was significantly less than other eyes (20.16 mmHg). This observation is similar to the results observed in non-filtered eyes following cataract surgery.[25-29] There is increasing evidence suggesting that the magnitude of IOP reduction following cataract surgery is positively correlated with the level of preoperative IOP.[22,27-29] In our study, mean IOP reduction in 7 patients with preoperative pressure >21 mmHg was 11 mmHg (from 27.8 mmHg preoperatively to 16.5 mmHg postoperatively). Although we did not evaluate bleb morphology in our series, we postulate that the benefit of cataract surgery in reducing appositional closure and lowering IOP in PACG eyes counteracts the adverse effect of inflammation in compromising bleb function particularly in eyes with higher preoperative IOP.

Consistent with previous studies on PACG patients, we detected an increase in AC depth after cataract surgery.[24,30,31] Likewise, a greater postoperative decrease in IOP was associated with shallower preoperative AC depth.[19,30] There is greater widening of the drainage angle in eyes with shallower AC depth.[30] A larger lens may play a predominant role in causing IOP elevation in these eyes. Additionally, the change in the force exerted on the ciliary body from capsular bag contraction after phacoemulsification may result in greater reduction of aqueous production in eyes with shallower preoperative AC.[31] Collectively, these observations may explain the positive correlation between shallow preoperative AC depth and lower postoperative IOPs.

Although phacoemulsification in eyes with PACG with functioning blebs is challenging, no serious complication such as corneal decompensation, wound burn, or posterior capsular rupture was observed in our study. Minor complications included temporary corneal edema (5.4%), and fibrin reaction (5.4%), which were managed successfully without visually significant sequelae. Other studies have reported serious complications;[8,32,33] Sudarshan et al[8] reported intra- and postoperative complications in 66 eyes, including iris trauma (18.3%), posterior capsule rupture (1.6%), minor wound burns (6.6%), temporary corneal edema (11.7%), and fibrinoid reaction (1.6%).

There are some limitations to this study. As patients in this study were of Iranian descent, the results may not be generalizable to other racial groups. New imaging techniques such as anterior segment optical coherence tomography and ultrasound biomicroscopy might be useful in evaluating biometric changes in the anterior segment following cataract surgery. Lastly, we did not include bleb morphology or function in our study. It is possible that cases with lower preoperative IOP had functional blebs and cataract surgery adversely affected the bleb similar to POAG patients. Alternatively, eyes with higher preoperative IOP had borderline or no bleb function, and thus were similar to PACG patients with no previous filtering surgery.

In summary, we observed a significant decrease in IOP and the number of glaucoma medications after phacoemulsification in filtered PACG eyes. The rate of IOP reduction was greater in eyes with higher preoperative IOP and shallower preoperative AC depth.

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Conflicts of Interest

None.

REFERENCES

1. Razzak A, Al Samarrai A, Sunba M. Incidence of posttrabeculectomy cataract among Arabs in Kuwait. *Ophthalmic Res* 1991;23:21-30.
2. AGIS (Advanced Glaucoma Intervention Study) Investigators. The Advanced Glaucoma Intervention Study: 8. Risk of cataract formation after trabeculectomy. *Arch Ophthalmol* 2001;119:1771-1779.
3. Akafo SK, Goulstine DB, Rosenthal AR. Long-term post trabeculectomy intraocular pressures. *Acta Ophthalmol (Copenh)* 1992;70:312-316.
4. Chen PP, Weaver YK, Budenz DL, Feuer WJ, Parrish RK 2nd. Trabeculectomy function after cataract extraction. *Ophthalmology* 1998;105:1928-1935.
5. Klink J, Schmitz B, Lieb WE, Klink T, Grein HJ, Sold-Darseff J, et al. Filtering bleb function after clear cornea phacoemulsification: a prospective study. *Br J Ophthalmol* 2005;89:597-601.
6. Halikiopoulos D, Moster MR, Azuara-Blanco A, Wilson RP, Schmidt CM, Spaeth GL, et al. The outcome of the functioning filter after subsequent cataract extraction. *Ophthalmic Surg Lasers* 2001;32:108-117.
7. Ehrnrooth P, Lehto I, Puska P, Laatikainen L. Phacoemulsification in trabeculectomized eyes. *Acta Ophthalmol Scand* 2005;83:561-566.
8. Khokhar S, Sindhu N, Pangtey MS. Phacoemulsification in filtered chronic angle closure glaucoma eyes. *Clin Experiment Ophthalmol*

2002;30:256-260.

9. Mietz H, Andresen A, Welsandt G, Krieglstein GK. Effect of cataract surgery on intraocular pressure in eyes with previous trabeculectomy. *Graefes Arch Clin Exp Ophthalmol* 2001;239:763-769.
10. Rebolleda G, Munoz-Negrete FJ. Phacoemulsification in eyes with functioning filtering blebs: a prospective study. *Ophthalmology* 2002;109:2248-2255.
11. Gunning F, Greve EL. Lens extraction for uncontrolled angle-closure glaucoma: long-term follow-up. *J Cataract Refract Surg* 1998;24:1347-1356.
12. Mierzejewski A, Eliks I, Kałuzny B, Zygulska M, Harasimowicz B, Kałuzny JJ. Cataract phacoemulsification and intraocular pressure in glaucoma patients. *Klin Oczna* 2008;110:11-17.
13. Zhuo YH, Wang M, Li Y, Hao YT, Lin MK, Fang M, et al. Phacoemulsification treatment of subjects with acute primary angle closure and chronic primary angle-closure glaucoma. *J Glaucoma* 2009;18:646-651.
14. Chan W, García JA, Newland HS, Muecke J, McGovern S, Selva D, et al. Killing two birds with one stone: the potential effect of cataract surgery on the incidence of primary angle closure glaucoma in a high-risk population. *Clin Experiment Ophthalmol* 2011;40:e128-134.
15. Moghimi S, Lin S. Role of phacoemulsification in angle closure glaucoma. *Yan Ke Xue Bao* 2011;26:121-131.
16. Sommer A. Collaborative normal-tension glaucoma study. *Am J Ophthalmol* 1999;128:776-777.
17. Swamynathan K, Capistrano AP, Cantor LB, WuDunn D. Effect of temporal corneal phacoemulsification on intraocular pressure in eyes with prior trabeculectomy with an antimetabolite. *Ophthalmology* 2004;111:674-678.
18. Sharma TK, Arora S, Corridan PG. Phacoemulsification in patients with previous trabeculectomy: role of 5-fluorouracil. *Eye (Lond)* 2007;21:780-783.
19. Shahid H, Salmon JF. Use of 5-Fluorouracil injections to reduce the risk of trabeculectomy bleb failure after cataract surgery. *J Ocul Pharmacol Ther* 2010;26:119-123.
20. Drolsum L, Haaskjold E. Extracapsular cataract extraction in eyes previously operated for glaucoma. *Acta Ophthalmol (Copenh)* 1994;72:273-278.
21. Park HJ, Weitzman M, Caprioli J. Temporal corneal phacoemulsification combined with superior trabeculectomy. A retrospective case-control study. *Arch Ophthalmol* 1997;115:318-323.
22. Shrivastava A, Singh K. The effect of cataract extraction on intraocular pressure. *Curr Opin Ophthalmol* 2010;21:118-122.
23. Poley BJ, Lindstrom RL, Samuelson TW. Long-term effects of phacoemulsification with intraocular lens implantation in normotensive and ocular hypertensive eyes. *J Cataract Refract Surg* 2008;34:735-742.
24. Shingleton BJ, Pasternack JJ, Hung JW, O'Donoghue MW. Three and five year changes in intraocular pressures after clear corneal phacoemulsification in open angle glaucoma patients, glaucoma suspects, and normal patients. *J Glaucoma* 2006;15:494.
25. Hayashi K, Hayashi H, Nakao F, Hayashi F. Effect of cataract surgery on intraocular pressure control in glaucoma patients. *J Cataract Refract Surg* 2001;27:1779-1786.
26. Park SW, Heo H, Yang KJ. Comparison of ultrasound biomicroscopic changes after glaucoma triple procedure and trabeculectomy in eyes with primary angle closure glaucoma. *J Glaucoma* 2009;18:311-315.
27. Poley BJ, Lindstrom RL, Samuelson TW, Schulze R Jr. Intraocular pressure reduction after phacoemulsification with intraocular lens implantation in glaucomatous and nonglaucomatous eyes: evaluation of a causal relationship between the natural lens and open-angle glaucoma. *J Cataract Refract Surg* 2009;35:1946-1955.
28. Hayashi K, Hayashi H, Nakao F, Hayashi F. Changes in anterior chamber angle width and depth after intraocular lens implantation in eyes with glaucoma. *Ophthalmology* 2000;107:698-703.
29. Euswas A, Warrasak S. Intraocular pressure control following phacoemulsification in patients with chronic angle closure glaucoma. *J Med Assoc Thai* 2005;88:S121-S125.
30. Liu CJ, Cheng CY, Wu CW, Lau LI, Chou JC, Hsu WM. Factors predicting intraocular pressure control after phacoemulsification in angle-closure glaucoma. *Arch Ophthalmol* 2006;124:1390-1394.
31. Issa S, Pacheco J, Mahmood U, Nolan J, Beatty S. A novel index for predicting intraocular pressure reduction following cataract surgery. *Br J Ophthalmol* 2005;89:543-546.
32. Lai JS, Tham CCY, Chan JC. The clinical outcomes of cataract extraction by phacoemulsification in eyes with primary angle-closure glaucoma (PACG) and co-existing cataract: a prospective case series. *J Glaucoma* 2006;15:47-52.
33. Fakhraie G, Vahedian Z, Moghimi S, Eslami Y, Zarei R, Oskouee JF. Phacoemulsification and goniosynechialysis for the management of refractory acute angle closure. *Eur J Ophthalmol* 2012;22:714-718.